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ABSTRACT

Two experiments were conducted to assess the effects of knowledge schema training and text organization on the comprehension and recall of scientific prose. The first experiment tested whether or not knowledge schema training improves processing and recall of a passage on plate tectonics (32 college subjects served as subjects). The second experiment investigated the effectiveness of using a knowledge schema to organize the prose passage in addition to replicating and extending the results of the first experiment (88 general psychology students served as subjects). As a preliminary step, a knowledge schema specifying the categories of knowledge important to understanding a scientific theory was developed. Results of both experiments indicated that training students to use this schema as a processing aid significantly facilitated recall performance. In addition, it was found in the second experiment that organizing the presentation sequence of major concepts of the passage according to this knowledge schema significantly improved subsequent recall in comparison to a coherent, alternate presentation sequence. It is suggested that increasing students' comprehension and recall may be accomplished by training students to use a set of specified knowledge schema relevant to a number of areas and organizing material according to this same set of knowledge schemata. (Author/JN)

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Effects of Individual Differences, Processing Instructions, and Outline and Heading Characteristics on Learning from Introductory Science Text

Section 4: The Effects of Schema Training and Text Organization on Descriptive Prose Processing

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FINAL REPORT
January 1982

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TABLE OF CONTENTS

Section 1: Utilizing Intact and Embedded Headings as Processing Aids with Non-Narrative Text

Section 2: The Effects of Author-Provided Headings on Text Processing

Section 3: Generation of Descriptive Text Headings

Section 4: The Effects of Schema Training and Text Organization on Descriptive Prose Processing

General Summary

A series of experiments were conducted to examine the impact of author-provided and student-generated headings on the recall of 2,500-word excerpts from basic science textbooks. If the students are sensitized to the presence of author-provided embedded headings, the delayed recall is significantly enhanced in comparison to individuals studying text without headings. However, author-provided intact headings (i.e., outlines) did not lead to significart improvements in recall.

Instructing students on using embedded headings to aid in the comprehension, storage, and retrieval of the text information led to even further improvements in delayed recall performance in comparison to groups receiving either no headings or no instructions on using headings. However, limiting instructions to only the inputting or outputting of the text material did not prove to be effective.

Since many texts contain only sparse headings or no headings at all, the impact of students generating their own headings was assessed. This generation activity led to improvements in delayed recall in comparison to either author-provided headings or no headings.

Intermediate between having the students generate their own headings and directly employing author-provided headings is an approach which provides the students with a generalized set of headings (knowledge schema) that can be imposed on a variety of texts. A knowledge schema for scientific theories was created and students were trained in its use as a text processing technique. Two studies indicated that this training led to improved recall

in comparison to students using their normal study methods. In addition text organized according to this schema was recalled better than text organized in a coherent, alternate presentation sequence.

In conclusion, the results of the reported series of experiments suggest that under most conditions author-provided, embedded headings facilitate descriptive text processing. Further, having students generate their own headings or having them impose a general set of categories (knowledge schema) on a body of text appears to result in even more effective text recall. The pragmatic and theoretical implications of these findings are discussed within each section of the report.

This final report consists of descriptions of a series of experiments conducted to examine the role of topic headings (author-provided and student-generated) in text processing. These experiments fulfill the requirements set forth in NIE Grant Number NIE-G-79-0157.

The Effects of Schema Training and Text Organization on Descriptive Prose Processing

Abstract

Two experiments were conducted to assess the effects of knowledge schema training and text organization on the comprehension and recall of scientific prose. As a preliminary step, a knowledge schema specifying the categories of knowledge important to understanding a scientific theory was developed. The results of both experiments indicate that training students to use this schema as a processing aid significantly (ps $<.05$) facilitated recall performance. Additionally, it was found in the second experiment that organizing the presentation sequence of the major concepts of a passage according to this knowledge schema significantly improved subsequent recall in comparison to a coherent, alternate presentation sequence ($p<.05$). These experiments represent an extension of schema theoretic notions to educationally relevant tasks and materials.

The Effects of Schema Training and Text Organization on Descriptive Prose Processing

In recent years schema theory has been the focus of numerous research efforts in the prose processing literature (e.g., Anderson, 1977). The central proposition of schema theory as it applies to text processing is that the prior knowledge of the reader and the context of the situation (titles, headings, and other immediately preceding material) interact to influence the interpretation and subsequent recall of new information. From this conceptualization the prior knowledge of the reader is seen to be organized as a set of schemata, and the context of the situation is thought to activate or inhibit particualr sets of schemata.

A schema can be described as the abstract prototype of a class of objects, events, or situations. Schemata are usually viewed as being hierarchically arranged into various sub-sets of placeholders within more general or higher order schemata. As an example, a face schema (Palmer, 1975) would contain placeholders for eyes, ears, nose, mouth, etc. When the appropriate placeholder for each of these objects is activated during either retrieval or encoding, the placeholder is said to be instantiated.

Two types of schemata have been identified by Rigney and Munro (1977)--content and form schemata. These two classes of schemata vary along a continuum of specificity and abstraction. At one end of this continuum are content schemata which can be thought of as being relatively specific and concrete. As an

example, a content schema for a journal article would possibly include the topic of the article, and specific information on the statistical techniques employed. On the other hand, the more abstract form schemata would be likely to contain general information about the format of the article (e.g., the fact that most articles consist of the following sub-sections: Introduction, Method, Results, and Discussion).

Obviously, the distinction between content and form schemata is somewhat arbitrary, but it does serve to point out an important dimension along which schemata can vary. Prior research on prose processing from the schema perspective has typically employed the activation of relatively specific content schema that are derived from the individual's experiences in a particular domain (e.g., "Washing Clothes," Bransford & Johnson, 1973). This type of schema clearly plays an important role in understanding and recalling narrative prose, but does not seem to be directly generalizable to many types of academic materials where the individual does not have a stored set of directly relevant experiences (e.g., understanding the theory of "continental drift"). In these situations it would appear that more abstract form schemata would be of greater importance. In particular, the processing of academic material should be facilitated by form schemata which specify the set of categories of information a well-informed learner should know about a particular topic (these types of schemata will be labeled knowledge schemata). Unfortunately, this aspect of schema theory has not been previously investigated. It is, however, an important one if schema theory is to have practical implications for academic

learning. By focusing on the use of knowledge schemata as facilitators of descriptive prose learning, the present experiments are initial steps in expanding schema theory to the field of applied educational psychology.

Knowledge schemata as defined here are analogous to Kintsch's (1977) schemata for stories. These story schemata contain the general frames or categories that are typically important in understanding narrative prose. The results of an experiment by Thorndyke (1977) support the importance of these types of narrative schemata. He foudn that subjects who initially received a narrative passage identical in structure, but unrelated in content to a target passage, recalled 22% more of the information in the target text than did subjects who initially received a narrative passage unrelated in both structure and content to the target passage.

Also related to the present use of knowledge schemata is Anderson, Spiro, and Anderson's (1977) example of a Nation schema. These authors have speculated that a mature reader, when encountering a passage concerning an unfamiliar nation, will have an already formed schema with categories for important characteristics (e.g., topography, economy, etc.) that are generally associated with a nation. The learner's task then is to fill in each of these categories with the appropriate information.

To assess the effectiveness of training students in the use of a knowledge schema as a text processing aid, two experiments were performed. The first experiment was designed to test whether or not knowledge schema training improves processing and recall of scientific text. The second experiment investigated the effective-

3. CONSEQUENCES -- A concise summary of how the theory has influenced man. This should include:
   a. Applications
   b. Beliefs
4. EVIDENCE -- A short summary of facts which support or refute the theory. This should include:
   a. Experiments
   b. Observations
5. OTHER THEORIES -- A concise summary of theories dealing with the same phenomena. These are usually of two types:
   a. Competing theories
   b. Similar theories
6. X-TRA INFORMATION -- An open category which should include any important information not in one of the other five DICEOX categories.

The first experiment presented here was an attempt to assess the overall effectiveness of DICEOX training. It was felt that once this was demonstrated, then more detailed questions concerning various aspects of this procedure could be addressed in the second study.

Experiment 1

Method

Participants. Thirty-two students enrolled in a Techniques of College Learning class participated as part of their course requirement. These students were randomly assigned to two groups: The DICEOX group (n=14), which received training on the use of

ness of using a knowledge schema to organize a prose passage in addition to replicating and extending the results of the initial experiment.

The knowledge schema to be employed in the present experiments specifies the categories of knowledge representing an individual's understanding of a scientific theory. This schema was created on the basis of a survey given to thirty individuals at various levels of education (e.g., from freshman college students to upper level graduate students). The survey required each person to list what he or she considered to be the important categories of information relevant to understanding a scientific theory. Informal analysis revealed that these responses could be subsumed under six basic headings. Each of these six categories could be further divided into sets of subcategories. This information was then combined to form the following knowledge schema (given the acronym DICEOX to facilitate retention):

1. DESCRIPTION -- A short summary of the theory which should include:
    a. Phenomena
    b. Predictions
    c. Observations
    d. Definitions
2. INVENTOR/HISTORY -- A brief account of the theory's history which should include:
    a. Name(s)
    b. Date
    c. Historical background

knowledge schemata, and the control group (n=17), which received instructions and participated in group discussions on concentration management (see Collins, Dansereau, Garland, Holley, & McDonald, 1981) during studying and test-taking. Because of ethical considerations related to not training all students enrolled in the class, both the DICEOX and control groups were given training. The major effect of this procedure is to potentially create a more conservative test for the effectiveness of the DICEOX training.

Materials. A 2,500-word passage dealing with the theory of plate tectonics was used as the material to be learned. This passage, which was extracted from an introductory college level geology textbook, has been used in previous studies on prose processing (e.g., Dansereau, Holley, Collins, Brooks, & Larson, Note 1). All passage headings were deleted because of their possible effect as schematic cues. It should be emphasized that the plate tectonics passage and the DICEOX schema were developed independently of each other.

The Delta Vocabulary Test (Deignan, 1973) was employed as a measure of individual differences. This test has been used in prior experiments on prose processing (e.g., Dansereau et al., Note 1), and has been shown to have moderate correlations with other measures of verbal ability such as the Scholastic Aptitude Test. In the present experiment this measure was used as a covariate. A free recall essay test was used as the dependent measure. This test required the participants to produce a well-organized summary of the stimulus passage.

Procedure. In the first session participants were asked to sign consent forms, and were given the Delta Vocabulary Test. In a subsequent session all participants were randomly divided into two groups. The DICEOX group received six hours of instruction over a two-week period on the use of knowledge schemata as learning aids. This training occurred in two phases. In the first phase this group was introduced via workbooks to a number of knowledge schemata related to five basic informational areas typically encountered in college learning (theories, events, systems, techniques, and objects). In the second phase participants were trained on the use of a particular knowledge schema (DICEOX) relevant to learning scientific theories.

Aspects of this latter training included having the participants do the following:

1. Memorize the DICEOX schema.
2. Organize their text notes according to the DICEOX schema using prepared format sheets as a guide.
3. Use the DICEOX schema as a retrieval and organizational aid while taking tests over text material.

During the course of this training the participants practiced these techniques on three passages of approximately 750 words in length. Participants were allowed to use either experimenter provided passages or to use passages relevant to their other courses. All of the practice material used during the training period was unrelated in content to the dependent measure passage (plate tectonics).

The second group (control) received training on support strategies (Dansereau, Collins, McDonald, Holley, Garland, Diekhoff,

& Evans, 1979) during the same two-week period. This training introduced the participants to relaxation techniques, study time management systems, and affective control strategies as aids in learning. This information was communicated via written text material, short lectures, and small group discussion. Participants were instructed to use these techniques in their regular coursework.

The last two sessions were devoted to testing. During the next to last session all participants read and studied the plate tectonics passage for 55 minutes. During the final session, which occurred 5 days following the previous session, participants were administered the free recall test (17 minutes administration time).

Results

The dependent measure was scored without knowledge of group affiliation, and according to a predetermined key. It should be noted that the plate tectonics passage and the scoring system for the free recall measure have been used in previous studies (e.g., Collins et al., 1981; Dansereau et al., 1979), and were, therefore, developed independently of the DICEOX schema. Also, in order to assess interrater reliability for scoring of the essay test, a random subset of these exams was scored by a colleague not otherwise associated with the experiment. A reliability coefficient of .93 was obtained, and considered an adequate degree of reliability between the two scorers.

A one-way analysis of covariance, with Delta Vocabulary scores as the covariate, was conducted to assess the treatment effect. Before computing the analysis of covariance, the equality of within-groups regression slopes was tested. This analysis indicated that the assumption

of homogeneity of within-group regression coefficients was not violated, $F_{(1,29)} = .18$, $p \leq .67$. Consequently, the analysis of covariance was conducted as planned. Results of the ANCOVA revealed that the DICEOX group performed significantly better than the control group, $F_{(1,28)} = 4.79$, $p < .05$. Means and standard deviations are presented in Table 1.

Insert Table 1 about here

Discussion

The results of this experiment support the contention that students can be trained to effectively use a knowledge schema as an aid in processing scientifically oriented text material. This experiment represents one of the first demonstrations of the potential uses of schema theory in practical academic settings. Secondly, this study suggests one possible manner in which knowledge schemata may be constructed. At minimum, the face validity of the DICEOX schema was supported by the present results.

It should be noted also that in this first study the control group was given training that may have attenuated the differences between the two experimental groups. This possibility is supported by prior research which has shown that support strategies of the type communicated to the control group can increase performance on dependent measures similar to those used in the present study (Collins et al., 1981). Therefore, it appears that the current test of knowledge schema training is very conservative.

Experiment 2

The second experiment was designed to replicate and extend the

first experiment by examining the relationships between knowledge schema training and free and schema-cued recall of DICEOX-organized and alternately organized text material. More specifically a 2 (training vs. no training) x 2 (organized vs. alternate) x 2 (free vs. schema cued recall) design was used to address the following questions.

1. Do students who receive knowledge schema training outperform "control" students on the delayed free recall measure? This represents a direct replication of the initial study.

2. Is the main locus of effect of knowledge schema usage at input (comprehension and storage) or at output (retrieval)? This study tested this question by comparing training-control differences on free recall with differences on schema-cued recall (i.e., the DICEOX categories were used to create six short-answer questions). If the effect of knowledge schema usage is primarily on input then significant differences would be expected on both dependent measures. If it is primarily on output then one would expect differences on free recall and no differences on schema-cued recall.

3. Does DICEOX-organized text enhance recall compared to alternately organized text? To answer this question two forms of text were created: One in which the information udner each DICEOX category was proximally clustered (DICEOX-organization) and another in which the information in each category was interspersed throughout the text (alternate organization). It should be noted that the integrity of the text at the paragraph level was maintained in both organizations.

4. Are the training-control differences greater with text organized according to the DICEOX schema or with text organized so as not to be congruent with the DICEOX schema? To the extent that the knowledge schema provides a framework for organizing information it was expected that the training-control differential would increase with the alternate (non-DICEOX) organization of the text. In part, this assumption is based on past research (e.g., Balser, 1972) which has suggested that providing the reader with information about the conceptual organization of randomly organized prose improves recall performance. Additionally, this hypothesis seems to be generally congruent with "re-organization" theories of prose processing (e.g., Shimmerlik, 1978).

Method

Participants. Eighty-two undergraduates, recruited from General Psychology classes, were randomly assigned to the following four groups: DICEOX training-DICEOX organized text, DICEOX training-non-DICEOX organized text, Control-DICEOX organized, text, Control-non-DICEOX organized text. Each participant was given 4 hours experimental credit and paid a $4.00 fee.

Materials. Two theory oriented passages of approximately 750 words in length were used for practice (one was organized according to DICEOX, the other was alternately organized). A 2,500-word theory passage extracted from a geology textbook served as the test passage. Two versions of this passage were created (one organized according to DICEOX, the other to an alternate organization). The alternate, non-DICEOX, organization of the test passage was produced by retaining the first and last paragraphs in their original positions in order to maintain an overall cohesiveness

to the passage. The intervening paragraphs were reorganized under the constraint that a casual reader should not notice any peculiarities in the organization of the passage. The purpose of this manipulation was therefore, not to present students with a randomly organized passage, but with a coherent organization that differed as much as possible from the DICEOX organization. Free recall and schema-cued tests were created for the test passage. Each of these tests was scored for main level and detail level ideas.

Procedure. This experiment was conducted in three sessions. During the first session (~2 hours) the participants were given practice on the two 750-word passages. The DICEOX groups were given a short lecture and a handout on DICEOX prior to the practice session. This information provided the students with a brief rationale, details on the DICEOX schema categories, and short examples on the use of the schema during studying and test-taking. The control group was instructed to use thier "normal" study methods during the practice session.

During the second session (~1 hour and 15 minutes) all participants studied the test passage for approximately one hour, using the techniques appropriate for the instructions (DICEOX or Control) they were given during the first session. Five days later, they took tests over this material in session three (~1 hour). At the end of the third session the participants were debriefed, given experimental credit, and paid $4.00.

Results

The free recall and schema-cued recall measures were scored according to a pre-determined key by a colleague not otherwise associated with the experiment. Again, it should be noted that

the scoring system was developed independently of the DICEOX schema. A random subset of both measures was scored by one of the experimenters to assess interrater reliability. The scoring procedure appears to be sufficiently reliable with correlation coefficients of .81 and .85 for main and detail ideas scores on the schema-cued test, and correlation coefficients of .85 and .74 for the main and detail idea scores on the free recall test.

An inspection of the raw data distributions for each of the four groups indicated that some participants scored unusually high on the dependent measures. It was assumed that these outlying scores represented prior knowledge concerning the assessment passage and did not reflect behavior due to the treatment conditions. Therefore, individuals who scored more than two standard deviations away from the mean on the dependent measures were deleted from all subsequent analyses. Removal of the outliers resulted in one participant being dropped from each of the four groups giving a total N of 78.

Following the removal of outliers from the data set, three-way analyses of covariance (ANCOVAs) with one repeated-measure factor were computed for the main ideas and detail ideas measures separately. The two between subject factors were (1) the DICEOX/Knowledge Schema Training factor (training vs. no training), and (2) the Text Organization factor (DICEOX organization vs. alternate organization). The within subject factor consisted of the two dependent variables (free recall and schema-cued recall). To control for type 1 error, Bonferroni critical F_B values were used to determine significance (Huitema, 1980).

Prior to the computation of the two ANCOVAs, the assumptions of homogeneity of the regression slopes for each analysis was assessed. F values of $0.25_{(3,70)}$ and $0.77_{(3,70)}$ were obtained for the main and detail ideas respectfully, indicating that this assumption was not violated.

The ANCOVA for the main ideas measures revealed significant main effects for knowledge schema training (DICEOX), $F_B(1,73) = 6.30$, $p \leq .05$, and text organization, $F_B\ (1,73) = 6.00$, $p \leq .05$. The first order interaction between DICEOX training and the dependent measures was also significant, $F_B\ (1,74) = 9.21$, $p \leq .01$. The main effects for the dependent measure and all other interactions were nonsignificant. The means and standard deviations for each of the groups are presented in Table 2.

Insert Table 2 about here

Tukey's HSD post hoc test was used to further delineate the effects of the knowledge schema training by dependent measure interaction. Results of the pairwise comparisons among the means for the DICEOX-Free Recall ($M = 15.51$), DICEOX-Cued Recall ($M = 17.58$), Control-Free Recall ($M = 14.33$), and Control-Cued Recall ($M = 12.68$), (data was collapsed across the text organization factor) indicated a significant difference between the DICEOX-Cued Recall group and the Control-Free Recall group, $p < .05$, and between the DICEOX-Cued Recall group and the Control-Cued Recall group, $p < .01$. No other differences among the means were significant.

A significant interaction between DICEOX training and the dependent measures was observed for the detail ideas ANCOVA, F_B (1,74) = 6.18, $p < .01$. The main effects for the DICEOX treatment and organization factors, however, were not significant, nor were any other significant interaction effects obtained. Table 3 presents the means and standard deviations for the detail ideas.

Insert Table 3 about here

Again Tukey's HSD post hoc test was used to evaluate the knowledge schema training by dependent measure interaction. All pairwise comparisons among the means for each of the four groups were nonsignificant. The means for each of the four groups, collapsing across the text organization factor, were as follows: (DICEOX-Free Recall (M = 3.23), DICEOX-Cued Recall (M = 3.82), Control-Free Recall (M = 3.44), Control-Cued Recall (M = 2.59).

Discussion

As mentioned in the introduction this experiment addresses three major questions concerning the influence of knowledge schema training (DICEOX), passage organization, and type of recall (free vs. cued) on performance with complex prose material. This section is divided into three subsections, the major topic of each subsection is as follows: (1) the effects of knowledge schema training, (2) the effects of text organization, and (3) a general summary of the important points of the study and their implications.

I. The Effects of Knowledge Schema Training

A. Do students who receive knowledge schema training (DICEOX) outperform students who do not receive training?

The answer to this first question is definitely positive. The results of the main ideas ANCOVA show a strong trend for the DICEOX group to score higher on the dependent measures than the control groups. This result replicates the first experiment, and is especially encouraging given the short amount of training time allowed in the present study. That positive and reliable results can be obtained under these circumstances further suggests the feasibility of applying knowledge schema usage in everyday academic settings.

B. Do the effects of knowledge schema training interact with the type of recall (free vs. cued), and, if so, what implications does this have for differentiating between input and output processes?

Again, as for the main effects of schema training, both the analyses for main and detail ideas were similar in that a significant effect was obtained for the DICEOX x dependent measures interaction. Post hoc comparisons for the main ideas measures revealed that the DICEOX training was facilitated under the cued recall condition to a greater extent than under the free recall condition. On the other hand, post hoc analysis failed to show any significant differences among the treatment groups on the two dependent measures for the detail ideas. As can be seen in Table 3, however, it appears that the major difference between the DICEOX and Control groups is on the cued recall measure.

There are at least two possible interpretations of these findings. One possible scenario is that given the short amount of training time (approximately 1½ hours), the DICEOX schema and the procedure for using it were not incorporated enough by the individuals to be utilized efficiently. It may be that with the aid of the additional cues in the schema-cued recall measure students were able to use the DICEOX schema in a more beneficial manner than under circumstances where fewer cues were available (e.g., free recall). If this hypothesis is accurate it would be expected that given more training time and practice, the use of the DICEOX schema would significantly improve recall under non-cued conditions. This interpretation of the results is supported by the initial study presented in this paper which did find a significant difference between DICEOX and Control groups on a free recall measure. It may be that the crucial difference between experiment 1 and experiment 2 on this dimension is the longer period of training provided the DICEOX group in the first study.

A second possible interpretation is that the training group did better on the cued recall measure merely because of the similarity between the training procedure and the dependent variable. While the probability of the result being due to the above cause is impossible to rule out, it does seem less likely when one considers that a significant main effect was found for schema training, and that the pattern of the means is similar for both the free and cued recall measures.

As mentioned in the introduction, it was speculated that recall differences between the free and schema-cued recall measures would

serve as an indicator of the relative importance of input and output processes for the knowledge schema training procedure. The two patterns of results mentioned were: (1) that there would be significant differences on both the free and cued recall measures, and that this would imply that the effects of knowledge schema training was primarily on input processes; (2) that there would be a significant difference between the two groups on the free recall measure but not on the cued recall measure, and that this would indicate that the primary effects of knowledge schema training were on output processes. The obtained results were, therefore, somewhat unexpected in that the most salient difference between the two groups was on the cued recall measure. This result is attenuated to some extent by the fact that a significant main effect was found for knowledge schema training across both measures, and that, as mentioned previously, the same pattern of mean performance was observed for both measures. The most obvious conclusion to draw from these findings is that both input and output processes are affected by the training procedure. Given the general trend of the mean performance on the dependent measures it could also be assumed that knowledge schema training has a slightly greater influence on output processes than on input processes. This conclusion should be regarded with some caution, especially in light of the shortness of training time in the present study, and its possible effects already discussed.

Additionally, an inspection of the means in Tables 2 and 3 shows a slight decrement in performance for the control groups on the cued-recall measure as compared to the free-recall measure.

While the absence of this trend would not substantially change the interpretation of the data, it does deserve mention, especially given that lower mean recall was observed fairly consistently for both control groups across the two dependent measures. The authors feel that the most reasonable explanation is offered by the output interference literature (e.g., Dong, 1972; Roediger, 1974, 1978; Smith, 1971) which has basically found that in successive recall of categorized information the amount of recall per category decreases following recall of the previous category (especially following the first category). There is also evidence that this effect is stronger with longer recall times and larger categories (Smith, 1971). If one assumes that the free-recall exam was affecting the learner in a manner analogous to a categorized recall test for the complete passage and that the cued-recall exam was merely the presentation of additional categories the current results are quite sensible. It can further be assumed that this decrement in recall performance was attenuated by the DICEOX manipulation and, therefore, was not apparent in the mean performance of the DICEOX treatment groups.

II. Text Organization

A. Does the organization of the text (DICEOX vs. alternate) affect prose processing?

The results of this study show a strong effect for high level organization with DICEOX organized text facilitating recall performance. This finding is a contribution to research on written language structure which until recently has ignored the influence of organization within the context of descriptive text (e.g., Goetz & Armbruster, 1980). Furthermore, the majority of studies dealing with

text organization have primarily investigated different structural formats at the sentence level (e.g., Dansereau, Long, Evans, & Actkinson, 1980; Shimmerlik, 1978), in contrast to the present study which was concerned with a more global approach to organization. This "high" level orientation of the present organization scheme is similar to that of story grammars as defined by Stein and Glenn (1978). According to these authors, a typical story will have a hierarchical, prototypical internal structure, and this structure will influence the comprehension and recall of information presented in the stories. It may be that the DICEOX organization, while not necessarily prototypical, does facilitate descriptive discourse processing in a manner analogous to the influence of story grammars on narrative discourse processing. This reasoning stems from the speculation that the DICEOX organized passage, like story grammars, has a more salient and easily perceived organizational structure than the alternate passage, and that the DICEOX organized text is hierarchical in format compared to the nonhierarchical structure of the alternate passage. Also, the present experiment in conjunction with a previous study by Dansereau et al. (1980) does demonstrate that flexible and replicable procedures can be used to produce sequences of text material which are more facilitative of learning and recall than other less optimal sequences. This finding is especially encouraging in light of the generally mixed results that have been reported in this area of research in the past (e.g., Dansereau et al., 1980).

B. Are there any interactions between text organization and any other variables in the experiment?

While there were no interactions between text organization and knowledge schema training, or type of recall (free vs. cued), an interesting relationship was observed with level of recall (main vs. detail ideas). Text organization appears to affect the recall of main ideas but not the recall of detail ideas as seen by the strong difference obtained between the two types of organization on the main ideas ANCOVA and the almost complete lack of an effect on the detail ideas ANCOVA, F_B (1,73) = .17 (critical value = 5.23). This suggests that with the manipulation of high level textual organization that recall and processing of main level ideas are more influenced than are detail level ideas. One probable explanation for this effect is that the context in which detail ideas are presented (within paragraphs) is relatively unchanged by the current textual manipulation; on the other hand, the context in which the main ideas are presented (between paragraphs) is directly affected by the current manipulation. Whether this same pattern of results would be obtained given different levels of organization and/or recall is a subject for future studies.

Summary

The current experiments assessed the effects of knowledge schema training on the comprehension and recall of descriptive text. It was found that knowledge schema training does increase the amount of information recalled from moderate length text, particularly on a cued recall test. Text organized according to a pre-specified knowledge schema when compared to the same text organized in an alternate fashion was found to significantly increase the amount of recall for main ideas on free and cued recall measures.

The educational implications of these results are fairly straightforward. To increase students' comprehension and recall of descriptive prose one should: (1) train the students in the use of a set of specified knowledge schemata relevant to a number of areas, and (2) material should be organized according to this same set of knowledge schemata. This is, of course, a slight overstatement, but it is made in order to emphasize the direct educational implications of this study. Obviously the implementation of some or all of the procedures should be dependent on further research, and as with all new areas of research the current findings should be viewed with caution.

Reference Note

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Table 1

Experiment 1

Adjusted Means and Standard Deviations

for the Dependent Measure[1]

Group	Free Recall	
	M	SD
DICEOX (n=14)	16.11	6.20
Control (n=17)	11.09	6.01

[1]Scores adjusted for the Delta Reading Vocabulary Test

Table 2

Experiment 2

Adjusted Means and Standard Deviations

for the Main Ideas Dependent Measures[1]

Group	Type of Recall			
	Free		Schema-Cued	
	M	SD	M	SD
DICEOX-- Schema organized text (n=18)	17.42	3.39	18.82	7.26
DICEOX-- Alternately organized text (n=20)	13.59	5.30	16.07	6.68
Control-- Schema organized text (n=20)	15.97	5.76	13.48	5.19
Control-- Alternately organized text (n=20)	12.71	5.78	12.11	6.05

[1]Scores adjusted for the Delta Reading Vocabulary Test

Table 3

Experiment 2

Adjusted Means and Standard Deviations

for the Detail Ideas Dependent Measures[1]

Group	Type of Recall			
	Free		Schema-Cued	
	M	SD	M	SD
DICEOX-- Schema organized text (n=18)	3.24	2.18	3.16	2.23
DICEOX-- Alternately organized text (n=20)	3.22	2.09	4.48	2.71
Control-- Schema organized text (n=20)	3.68	1.97	2.64	1.89
Control-- Alternately organized text (n=20)	3.18	2.61	2.53	2.21

[1]Scores adjusted for the Delta Reading Vocabulary Test.